Second Harmonic Generation in amorphous Silicon Nitride doubly resonant microcavities with periodic dielectric mirrors

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Optical second harmonic generation (SHG) in planar microcavities (MCs) is a subject of growing interest. In the recent past, we demonstrated the possibility of fabricating MCs entirely based on amorphous silicon nitride *(*a-SiN:H) [1]. Later, SHG in silicon nitride microcavities with the pump wave being resonant with the Fabry-Pérot mode has been demonstrated [2]. These systems can be viewed as one-dimensional photonic crystals with defect cavity layers.

In this work, starting from theoretical studies [3], we report on the first realization of a doubly resonant microcavity based on periodical mirrors [4]. Differently from other proposed lay-outs with non-periodic multilayers [5], with the present microcavity design based on photonic crystal concepts the resonant features are robust with respect to moderate deviations of the layer thicknesses. Such deviations (plausible in realistic growth performed by MBE or PECVD) produce at the most a resonance shift, which can be compensated by tuning the angle of incidence and the polarizations of input and output beams.

SHG with simultaneous resonance at the pump and harmonic waves is demonstrated at finite values of the angle of incidence. The results are in good agreement with a theoretical calculation of the harmonic generation process based on a nonlinear polarization localized at the interfaces between different centrosymmetric layers.

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